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er treated with enzymes by a patented process
 orate complex molecular substances to similar

of agents added do not, in themselves or as
 diovascular effects.

ect when clinically tested on human beings, does
 effects.

re the elimination of nicotine in all smoking
 ill have reversed the effects of habituation.

of nicotine-free products will consistently
 and a goodly number will give it up altogether.

reporting of the hearings by the major press and
 the continuation of the smoking habit. The

more on various reporters who were light-
 than upon either the witness or the

media, the researchers that depend on govern-
 "non-profit organizations" that depend on

lives, the various state representatives who
 their economic standing, are the very forces

ideavor to public health safety. I would appre-
 plain your evaluation of our move toward

change our ways, or would you suggest that

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D. INSTITUTE OF HYGIENE, KAROLINSKA INSTI-
 RAGNAR RYLANDER, M.D., NATIONAL INSTITUTE
 SWEDEN, TO THE CONSUMER SUBCOMMITTEE OF
 MYCE

ology of cigarette smoke, based upon the
 exposure and occurrence of disease, has at-

ing recent years. In view of the effects which
 desirable to pay special attention to experi-

thereof are studied and where the exposure
 man conditions as possible.

lisa of the tracheal epithelium was developed
 T. Dalhamn.¹ Living, anaesthetized animals

re observed through a tracheotomy with the
 t. A flickering light reflex, caused by the

led in several studies of the acute toxicity of
 ther been administered by means of a smoke

a ringe, through the mouth of the animal
 the puff was 1 ml. which by body weight or

a puff of about 35 ml. The number of such
 is in the entire area of trachea observed is

between the individual cigarette was varied²
 as found both for a nonfilter and a cellulose-

en experiments, where the different compo-
 the use of different filters, a significant cor-

for "tar," nicotine, phenol and several volatile

of the Rate of the Ciliary Beat in the Trachea.

d, and R. Rylander. Machine for Introducing Regu-

lmal, Int. J. Air Water Poll. 7:511-515, 1968.

toxic Action of Cigarette Smoke: Varying Exposure

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components in the smoke.⁴ In later experiments, a dose-response relationship was
 found between tar and ciliastasis when cigarettes with varying amounts of "tar"
 in the smoke but otherwise of identical composition⁵ were administered.

A principally important result was found in an experiment where the dose-
 response relationship for smoke from a nonfilter cigarette and smoke from the
 same cigarette after passage through a Cambridge filter was studied.⁶ It was
 found that at higher dose levels, removal of particulate matter produced less of
 a reduction in ciliastasis than at lower dose levels.

The conclusions which can be drawn from these experiments are the following:

(1) A dose-response relationship exists between cilia-toxicity and whole
 smoke, as well as the particulate matter; dose-response relationships also
 exist for several volatile components.

(2) The dosage level used in experimental work is of importance—the higher
 the dose the less the reduction in ciliastasis by removal of particulate matter.

The experimental results upon which these conclusions are based involves the
 use of an *in vitro* preparation where the normal defense functions of the organ are
 intact, and where the exposure takes place under conditions reasonably com-
 parable to those encountered in human conditions.

The importance of administering the smoke through the mouth was demon-
 strated in experiments on humans where it was shown that volatile, water-soluble
 compounds were selectively absorbed in the mouth.⁷ Furthermore, it was shown
 in a special experiment⁸ that the results concerning the effect on cilia were
 different when an *in vitro* clam cilia method and the *in vivo* animal method were
 compared. The result from the last-mentioned experiments implies that results
 from experiments where exposure conditions or preparations studied are largely
 different from human conditions, may have but an academic interest in the
 present connection.

The results hitherto obtained with a method, which is considered to be reason-
 ably realistic as compared to human conditions, also implies that it is incorrect to
 attribute the toxic effect of tobacco smoke to one or a few special substances in
 the smoke. Furthermore, no epidemiological investigation has yet shown a scien-
 tifically acceptable correlation between some specific factor in the smoke and
 disease.

It is most likely that the toxic effect exerted by the cigarette smoke on humans
 is a highly complex and multistaged process where the interaction of several
 compounds in the smoke together with other environmental factors plays a very
 vital role. From theoretical point of view, it cannot be excluded that the selective
 removal of one or a few specific compounds might result in a smoke which is more
 toxic than the original product.

Our belief, based upon the scientific knowledge available at present, is that
that the only way to guarantee a reduction in the harmful effects of inhaled
cigarette smoke is to decrease the overall exposure. This can either be done by
reducing the number of cigarettes smoked or by using filter cigarettes, provided
that the reduction brought about by the filter will equal in all respects and for all
potentially hazardous compounds the reduction in dose obtained if the number of
cigarettes is reduced. Due to the limited amount of data and the difficulty of
extrapolating from laboratory findings to man, we believe that a reduction of only
selected components of cigarette smoke cannot be accompanied by a statement
guaranteeing a reduction in the harmful effects of inhaled smoke.

We feel that further research, aimed at elucidating the relative toxicity of
 various compounds and combinations thereof in the smoke, is a most important
 task and it should be undertaken, taking into consideration the requirements
 expressed here concerning experimental techniques.

⁴ Dalhamn, T., R. Rylander, Cigarette Smoke and Ciliastasis, Arch. Env. Health 13: 47-50, 1966.

⁵ Dalhamn, T., R. Rylander, Tar Content and Ciliotoxicity of Cigarette Smoke, Acta Pharmacol. Toxicol. 25:90-99, 1967.

⁶ Dalhamn, T., R. Rylander, Relative Ciliotoxicity of Aerosol and Volatile Constituents of Tobacco Smoke, Scand. J. Resp. Dis. 1968, 9:99-100.

⁷ Dalhamn, T., M-L Edfors, R. Rylander, Mouth Absorption of Various Compounds in Cigarette Smoke, Amer. Rev. Resp. Dis. 99:99-100, 1968.

⁸ Dalhamn, T., R. Rylander, A. W. Spears, Observed Differences in Ciliotoxicity of Cigarette Smoke Due to Exposure Methods, Am. Rev. Resp. Dis. 99:99-100, 1968.

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